

The challenge of health & environment: Profiling risks & strategic priorities for now & the future

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A substantial burden of communicable and non-communicable diseases in the developing countries is attributable to environmental risk factors. WHO estimates that the environmental factors are responsible for an estimated 24 per cent of the global burden of disease in terms of healthy life years lost and 23 per cent of all deaths; children being the worst sufferers. Given that the environment is linked with most of the Millennium Development Goals (MDGs), without proper attention to the environmental risk factors and their management, it will be difficult to achieve many MDGs by 2015. The impact of environmental degradation on health may continue well into the future and the situation in fact, is likely to get worse. In order to address this challenge, two facts are worth noting. First, that much of the environmental disease burden is attributable to a few critical risk factors which include unsafe water and sanitation, exposure to indoor smoke from cooking fuel, outdoor air pollution, exposure to chemicals such as arsenic, and climate change. Second, that environment and health aspects must become, as a matter of urgency, a national priority, both in terms of policy and resources allocation. To meet the challenge of health and environment now and in the future, the following strategic approaches must be considered which include conducting environmental and health impact assessments; strengthening national environmental health policy and infrastructure; fostering inter-sectoral co-ordination and partnerships; mobilizing public participation; and enhancing the leadership role of health in advocacy, stewardship and capacity building.

Key words Air pollution - disease burden - environmental risk - health

Disease or ill-health is often a result of an interplay between the environment, agent, and host factors. Environment is defined as all the physical, chemical and biological factors external to a person, and all the related behaviours^{1,2}. Human exposure to these factors present in the environment can have a profound influence on public health. Since many of these factors

are manmade, protecting the environment is not only in man's best interest, it is also a good investment from the health point of view.

Since a healthy environment is a prerequisite for a healthy population, and environmental factors are at the root cause of significant burden in terms of mortality and morbidity in the developing world, a

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holistic, comprehensive and integrated approach to health and environment is required to protect both the environment and public health. Progress in mortality reduction has although accelerated in recent years, the improvements have been uneven and large variations in health status persist both between and within countries³. Given also that the environment is linked with most of the Millennium Development Goals (MDGs), without proper attention being paid to the environmental risk factors and their management, it will be difficult to achieve many MDGs by 2015^{3,4}.

Forums such as the Rio +20 United Nations Conference on Sustainable Development in June 2012 in Brazil, as a follow up to the environment and development summit held in 1992 offer an opportunity to countries to deliberate on the issues associated with the environment and health and to agree on policies and programmes that will contribute towards saving the environment, and at the same time, protecting human health especially of the poor living in developing countries. Among the 27 principles agreed 20 years ago, the first was that "Human beings are at the centre of concern for sustainable development. They are entitled to a healthy and productive life in harmony with nature"⁵. Greater political commitment underpinned by better understanding of the health impact of various environmental factors can help countries use such data for designing and implementing their national environment and health policies based on scientific evidence.

This paper reviews some of the evidence on the common environmental risk factors that affect human health and proposes a few strategic approaches to protect human health from these risk factors.

Environment as a major determinant of health

Each year, 13 million or nearly one quarter of all deaths worldwide result from preventable environmental causes relating mainly to water, sanitation and hygiene; indoor and outdoor pollution; harmful use of chemicals such as pesticides; and climate change^{1,6}. These risk factors, which are both avoidable and preventable, play a role in more than 80 per cent of diseases that are routinely reported to the World Health Organization. Children, especially from poor families are most vulnerable to illness and death due to these diseases. However, simple and cost-effective interventions are available, which, if implemented early and effectively, can prevent most of these deaths.

Changes in the environment also lead to acute events and emergencies. The earthquake followed by a tsunami in Japan's Fukushima Daiichi on March 11, 2011 is considered as one of the greatest nuclear and environmental disasters in human history. The 2010 floods, the worst in the history of Pakistan killed more than 1500 people. During 2010-2011, unprecedented floods also took a heavy toll of life in Ladakh, northern India as well as in cities of Melbourne, Australia and Rio de Janeiro, Brazil. The long-standing health problems associated with ground water contamination with arsenic and fluoride in parts of India are examples of the health consequences associated with environmental risk factors⁷. The factors including globalization, rapid industrialization, urbanization, unplanned and unregulated development activities, increase in transport, over-dependence on pesticides in agriculture, and climate change indicate that the negative health consequences associated with environmental causes are likely to worsen in the future, unless action is taken urgently.

Burden of communicable and non-communicable diseases attributable to environmental risks

Recent studies and systematic reviews indicate that the environmental factors are responsible for an estimated 24 per cent of the global burden of disease in terms of healthy life years lost and 23 per cent of all deaths². While 25 per cent of all deaths in developing countries are attributable to environmental factors, only 17 per cent of deaths in the developed countries are due to such factors. Children are the worst sufferers of the adverse impact of environmental risks, as an estimated 24 per cent of all deaths in children under 15 are due to diarrhoeal diseases, malaria and respiratory diseases, all of which are environmentally-related².

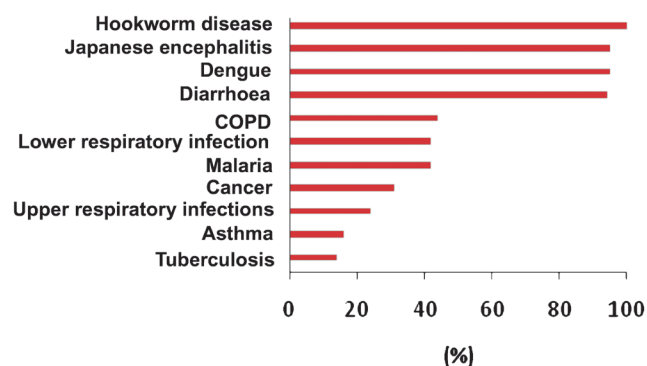


Fig. Diseases and the fraction attributable to environmental risk factors. *Source:* Adapted from Ref. 1.

It is also evident that much of the disease burden is attributable to a few critical risk factors (Table and Fig.). These include unsafe water and sanitation, exposure to indoor smoke from cooking fuel, outdoor air pollution, exposure to chemicals such as arsenic, and climate change. Unsafe water, sanitation and poor hygiene contribute to a large number of deaths, estimated at about 0.45 million in India alone.

While good progress has been made with respect to drinking water availability, the situation in many countries of Asia relating to sanitation continues to remain bad. Currently, 2.5 billion people lack sanitation facilities, with coverage being poorest in South Asia; as many as 629 million population in India is without sanitary facilities. According to UNICEF, 67 per cent of the rural population in India still practice open defecation^{8,9}. Among some countries of the South-East Asia Region namely Bangladesh, Bhutan, Sri Lanka, and India, the proportions of population without access to sanitation during 2010 were 44, 56, 8 and 66 per cent, respectively³. The progress in the region as a whole has been slow - from 34 per cent with sanitary facilities in 2000 to 43 per cent in 2010. Given this situation, it is clear that MDG 7 relating to water and sanitation is unlikely to be met by 2015.

The link with disease is clear as unsafe water and sanitation contribute to 94 per cent of the diarrhoeal disease burden. Unfortunately, drinking water and sanitation have not received the kind of political commitment these deserve although the benefits can go beyond health and economic development and to enhance personal and national dignity. Assigning the highest priority including allocation of appropriate

resources and fully integrating water, sanitation, and hygiene in disease reduction strategies is therefore, an important priority and an essential prerequisite for national development. Among the South-East Asia Region countries, only Nepal has higher proportion (69%) of population without access to improved sanitation than India³.

Indoor and outdoor pollution affect human health profoundly. Each year, an estimated 42 per cent of lower respiratory tract infections or pneumonia are associated with indoor and outdoor pollution including second hand-smoke¹⁰. Long-term exposure to suspended particulate matter from indoor burning of solid fuel such as wood is a major cause of respiratory diseases such as pneumonia, asthma, chronic obstructive lung diseases (COPD) especially among children¹¹⁻¹³. According to WHO, outdoor air pollution contributes to 800, 000 deaths each year globally and about 60 per cent of them are in Asia, caused by domestic consumption of fuel, motor vehicles especially those running on diesel, industries and burning of all kinds of waste². These factors together with second-hand smoking are leading to ischaemic heart disease, acute respiratory infections, asthma, and lung cancer.

Historically, environmental changes due to economic development have had a negative health impact. For example, construction of the Aswan dam in Egypt led to an increase in malaria and schistosomiasis. Deforestation in many countries of South Asia has led to soil erosion and flooding. Relationship between malaria, and rainfall and climate has been described since long^{14,15}. It is estimated that about 42 per cent of malaria occurring in Asia and Africa is attributed to environmental factors such as land use, deforestation and water resource management¹⁶. Similarly, growing rice crops, pig rearing, vector breeding and exposure to unsafe water all play an important role in transmission of acute encephalitis syndrome which, in 2011 alone accounted for 6800 cases and 820 deaths, mostly children below 15 yr, with the epicenter in the State of Uttar Pradesh, India (Dr A.K. Dhariwal, personal communication). The environmental factors contribute greatly to the impending pandemic of dengue as well as to transmission of schistosomiasis in many countries including China and Indonesia.

Cancer is the second leading cause of death worldwide. More than two thirds of all deaths due to cancer occur in developing countries. Of the 12.7 million cases each year, 19 per cent are estimated

Table. Environmental risk factors and the diseases contributed

Risk factors	Related diseases
Water, sanitation	Diarrhoeal diseases, trachoma, hookworm disease
Indoor air pollution	Pneumonia, COPD, lung cancer
Outdoor air pollution	Respiratory infections, cardio-pulmonary disease, lung cancer
Arsenic	Dermal keratosis, cancer
Climate change	Diarrhoeal diseases including cholera, malaria and other vector-borne diseases, asthma, COPD, malnutrition

Source: Adapted from Ref 1

COPD, chronic obstructive pulmonary disease

to be attributable to the environment¹⁷. Smoking is responsible for 71 per cent of all lung cancer deaths. The second most common cancer - stomach cancer due to *Helicobacter pylori* infection is associated with poor sanitation and overcrowding conditions where the poor live. Recently, many reports indicate an increasing incidence of cancer in agricultural heartland of Punjab^{18,19} and suggestions have been made of a possible link with environmental causes, such as use of pesticides which have been found both in water and soil.

Exposure to indoor smoke from solid fuel or tobacco smoke or by smog can trigger an asthma attack, especially during winter²⁰. In many cities in India and elsewhere this has resulted in a major increase in the number of children consulting health care workers for asthma. In one study carried out in New Delhi, India, hospital emergency room visits for asthma and chronic obstructive lung disease increased by 21 and 24 per cent due to high levels of ambient air pollution²¹. With regard to the prevalence of COPD which is clearly linked with environmental factors, the rates seem to vary between countries due to the level of environmental risk factors. More than one-third of deaths due to COPD, are attributable to environmental causes.

Specific examples of environment-related health crises

Reports on the hazard of ground water pollution in India date back to 1945^{22,23}. Today, 30 per cent of urban and 90 per cent of rural households in India depend on untreated surface or ground water and this causes an enormous adverse health impact in many areas²⁴. Two examples of a serious health situation due to contamination of ground water used for drinking purposes are of particular concern²⁴. These relate to fluoride and arsenic contamination of drinking water.

More than 60 million people living across 20 States of India are exposed to fluoride contamination (more than 1.5 mg/l) and are at risk of serious health effects, ranging from dental fluorosis to crippling skeletal fluorosis, both conditions being irreversible. Severe genu vulgam and bending of knees can lead to disability and economic hardship. Bone deformity results from an excess fluoride content in water which prevents absorption of calcium, essential for bone development. This condition, however, is preventable through water treatment.

High concentration of arsenic in ground water is a major public health problem in West Bengal

affecting nearly 50 million population. In Bangladesh, the arsenic problem is considered as a public health emergency - the largest poisoning of a population in history²⁵. Arsenic contamination has been detected in 59 of the 64 districts and 249 of the 463 sub-districts in Bangladesh. Estimates suggest that a quarter of the 6-8 million tube wells in Bangladesh may contain arsenic levels more than 50 ppb or 0.05 mg/l, the national standard. While the figures are unconfirmed, estimates indicate that between 30-40 million people are at risk through exposure from arsenic in drinking water. Arsenic can cause severe and irreversible health effects, even at low levels of exposure and over a prolonged period of time. The symptoms can start at childhood and with continued exposure get increasingly worse. Besides skin diseases such as hyperkeratosis, death due to cancer has been reported in recent years. Studies also show that arsenic can lead to diabetes and adversely affect health^{26,27}. Provision of arsenic-free drinking water can prevent this public health problem.

In addition, environmental conditions make South Asia prone to disasters and public health emergencies such as floods and earthquakes which cause much suffering and economic loss. The situation is likely to get worse due to climate change and the health impact is likely to be serious for poor people living in developing world especially in Asia and Africa²⁸⁻³⁰. It will lead to an increase in vector-borne and water-borne diseases, heat stroke, asthma, cardiovascular diseases, and threaten food security by causing more floods and drought. While reducing greenhouse emissions is an individual responsibility, urgent action at adaptation is necessary by strengthening surveillance and response capacities in the countries to enable them to be resilient in coping with the adverse impact of climate change.

Environment and health impact assessment: a key for policy and programme development

It is now widely accepted that several factors combine and affect human health. Besides the environment, these include socio-economic factors, prevailing customs and traditions as well programmes and policies, and the access and use of health services by the affected communities.

The paucity of such information at the national level remains a major constraint for advocacy. To fill this information gap, environment and health impact assessments can help in systematically identifying the policies, programmes or developmental activities that are likely to have a major impact on the health of the

local population. Such information can make a critical input for deciding on the right policies and projects.

Assessment is a multi-disciplinary approach in which a combination of methods is used to obtain qualitative and quantitative data preferably using a check list. Such an assessment can also identify the risk factors that can lead to health problems in relation to such activities as construction of buildings, transport systems, housing, energy, industry, urbanization, water, nutrition, *etc.*

The data so obtained can help guide decision makers while planning and implementing such policies, programmes and development projects. Such information can also help all relevant sectors and local bodies to (i) understand health consequences of various projects, (ii) keep health in mind while planning and implementing new projects and agree to the concept of “health in all policies” as a guiding principle, and (iii) finally ensure that the health of the local population is safeguarded while engaging in a new project or development activity.

Protecting health and preventing disease through healthy environments

It is clear that environmental factors will continue to have an impact well into the future and, in fact, the situation is likely to get worse.

A few strategic approaches are highlighted below that can help mitigate the health problems arising from environmental causes and to meet the challenge of health and environment:

(i) *Developing an evidence-base for action:* There is, at present a paucity of information on the environmental health impact in the countries, the transmission pathways, and on the populations at risk. More detailed and precise data on the health impact relating to water, air, food, and climate which could help in setting priorities and developing appropriate national policies are needed. More focused research is needed to understand the environmental factors, and their impact on economic development and on the daily lives of the people. A national database on health and environment can help establish and monitor the relationship between the distribution and trends of various diseases associated with environmental risk factors, the areas which are vulnerable and where risks are high, and the populations having the greatest need for environmental and health interventions.

A mechanism for collecting and sharing information on environment and health and on country experiences could be useful. Best practices in India such as use of plastics for road construction work, and levying “green tax” on vehicles entering Manali and using it for environmental protection in Himachal Pradesh, provision of gas cylinders to populations in Uttarakhand so that they do not have to go to the forest for firewood and thereby protecting the forest cover, solar energy expansion in Gujarat, total sanitation programme in States such as Haryana, Sulabh experience in technical innovation in low cost toilets, ban on *gutka* and *pan masala* by Madhya Pradesh and seven other States in India, constructing ecological latrines in Nepal and many such examples could be shared through an information clearing house.

(ii) *Strengthening national environmental health policy, strategy and infrastructure:* To address issues relating to health and the environment requires a comprehensive and inter-sectoral approach through preparation and implementation of a national environment and health action plan (NEHAP). Supported with data from the environment and health impact assessment, a working group with representatives from the environment, health and other sectors can identify priorities which can then be adopted by the Ministries of Health and Environment. The plan, along with allocation of adequate human and financial resources if implemented seriously and on a sustained manner, can go a long way to mitigate the problem emanating from the interaction between the environment and health. A national advisory board on environment and health can help advise and periodically monitor implementation of the plan.

Strengthening physical infrastructure such as provision of safe drinking water supply, functioning sewage treatment system, availability of non-polluting fuel for motor vehicles, clean cookstoves, biogas and solid waste management are responsibilities that national and local governments must take seriously and urgently. Proper allocation of resources for such services if demanded by the general population can become a priority for decision makers.

(iii) *Sustaining inter-sectoral co-ordination and partnerships:* Most environmental risk factors lie outside the health sector, the action to protect human health therefore, cuts across various sectors such as the government sector namely Ministries of Environment, Agriculture, Transport, Energy, Urban Development, Water Resources and Rural Development, as well as

the private sector. Currently in many countries there is lack of effective co-ordination among these sectors.

A broad-based, high-level national steering committee represented by various relevant government ministries, civil society including non-governmental organizations, the private sector and chaired by the highest level of government meeting at regular intervals could help mobilize all sectors and ensure a co-ordinated implementation of NEHAP.

Many programmes are presently underway that deal directly or indirectly with health and environment. There is a need to bring synergy among these programmes such as diarrhoeal disease control, water and sanitation, non-communicable diseases, *etc.* An overarching mechanism for functional collaboration among various programmes could assist in joint planning, decision making on priorities, and on deciding on activities to monitor.

(iv) *Augmenting public participation and social mobilization:* Protecting the environment is every citizen's responsibility. To keep the environment clean now and for future generations, it is necessary to enlist support from the public to safeguard fresh water sources, observe good sanitary practices and personal hygiene, and discourage all actions that harm the environment. The media and community-based organizations have an important role to play in creating public awareness in both urban and rural areas. While the former can reach a large section of the population with health messages using electronic or print media, community-based organizations can use an interpersonal approach and facilitate behaviour change.

A social movement is needed to discourage traditional practices such as open defecation, throwing garbage including plastic bottles and bags on the road, and burning of all kinds of waste; and promote practices such as hand washing and personal hygiene, "reducing, reusing and recycling" items such as papers, using only eco-friendly and biodegradable materials, promoting the use of public transport, planting more trees, and avoiding second-hand smoke.

(v) *The stewardship role of health and capacity building:* Health has a critical role in advocacy and in mobilizing and supporting other sectors to contribute in the area of health and environment. In order to do so, leadership skills of health professionals must be built in negotiating with other relevant sectors to play their role in protecting the environment and health.

The health sector could also take a lead in carrying out health impact assessments and advise other sectors in developing policies that protect human health. In addition, health professionals, civil society and other stakeholders need to be periodically re-oriented on environmental health issues and priorities.

Conclusions

The environment has a major impact on health and investing in environmental health is certainly a good investment. Rapid urbanization, industrialization, globalization and an increasing population is putting further stress on the environment. If strategic actions are not taken urgently by all sectors, the problem is likely to worsen thereby impacting human health directly. The impact will be hardest on the poor and vulnerable sections of the population. Given that the environment is closely linked with each of the eight MDGs, without priority being assigned to interaction between environment and health, it will be a challenge to achieve MDGs. The future of the planet now rests solely on what we decide and do TODAY.

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